Swami Ramanand Teerth Marathwada University,
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"Studies on the Exotic Tilapia species and their Impacts on Native Fishes of Selected Water Bodies of Parbhani , MH, India"

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Abstract of Proposed Work Plan/ Problem

Topic of Research – "**Studies on the Exotic Tilapia species and their Impacts on Native Fishes of Selected Water Bodies of Parbhani, MH, India"**

Introduction

Aquaculture production has increased steadily in recent years and is the fastest growing food production sector and has become a valuable component of national development and poverty reduction plans in many areas of the world [1]. Aquaculture is one of the fastest growing sectors of the global livestock production [2]. Approximately 40% of fish from aquaculture is originated from tilapia production [3]. Aquaculture is currently playing, and will continue to play, a big part in boosting global fish production and in meeting the rising demand of fishery products.

Global inland waters capture production reached 11.6 million tonnes in 2012. Total farmed food fish production has increased from 50 % in 1980 to 63 % in 2012. In the world scenario, 15 countries produced 92.7 % of all farmed food fish in 2012. India, Bangladesh, Egypt, Myanmar and Brazil depend mainly on inland aquaculture of finfish while their potential for mariculture production of finfish remains largely untapped [4].

Capture fisheries production has leveled off and is no longer considered capable of sustaining the supply of fisheries products needed to meet the growing global demand [5]. Aquaculture, especially of tilapias, has the potential to play a leading role in the fight against food insecurity, malnutrition, and poverty in Africa [6]. Tilapia is the common name for several species of cichlidfish inhabiting freshwater streams, ponds, rivers and lakes and less commonly in brackish water. Considered as an *invasive* species, tilapias are now of increasing importance in Aquaculture. Tilapia is the *second most* farmed fish world-wide and its production has quadrupled over the past decade because of its suitability for aquaculture, marketability and stable market prices [7].

The Nile tilapia, *Oreochromis niloticus* is considered as one of the most important species of fish in tropical and sub-tropical aquaculture [4]. It serves as an important sources of animal protein and income throughout the world [8]. Tilapia can grow and reproduce facing a wide range of environmental conditions and tolerate stress induced by handling [9]. The mono- sex male population of tilapia are well recognized for increased production potential and low

management requirements [10]. Today, tilapia has become the shining star of aquaculture and also popularly known as '**aquatic chicken**' and the rate of consumption has increased across the globe [11]. Annual global production of cultured tilapia has increased continuously in recent years [9].

Unlike most other finfish species, tilapias are extremely hardy fish equally adaptable to a range of culture systems such as low density pond systems, cage culture systems, raceway systems and super-intensive culture systems under a wide range of environmental conditions. Due to its easiness of breeding and farming, low protein requirement and ability to assimilate plant protein, it became the species of interest among the resource poor especially in rural areas. This fish is also popular and prized in many Asian countries, including the Philippines and Indonesia, where local people adopted it as a vital part of the national cuisine and as a native species of their country [14]. During the 1970's, this fish inspired the International Development Agencies to name it as "Aquatic Chicken" and twenty years later as "**fish of the 1990's**". Presently it is considered as "**Food fish of the 21St Century**" [15,16].

Asian countries are the major producers as well as the consumers of tilapia. World aquaculture production of *Oreochromis niloticus* alone presently stands at nearly **3.2 million tons** with China being the major producer, contributing over one third of the total global production. Tilapias are also widely farmed in countries such as Egypt, Indonesia, Thailand, Philippines, Brazil, Bangladesh, Vietnam, Columbia and Malaysia. An international collaborative project to improve the genetic performance of farmed Nile tilapia (*Oreochromis niloticus*) was initiated at the Bureau of Fisheries and Aquatic Resources/Freshwater Aquaculture Center (BFAR/FAC) facilities in Muñoz, Philippines in 1988 [17,13].

Masoli Dam (Gangakhed, Parbhani) Lattitude 16.1035393 and Longitude 74.1797766 and Wakadi Dam (Selu, Parbhani) Lattitude 20.046255 and Longitude 76.693497 are biggest water bodies in Parbhani District. These water bodies are major source for fish diversity, and accommodating population of various fish species (exotic as well as native fishes). In view of that above water bodies were selected for proposed research work.

Fishes are one of the major groups of introduced species, and a total of 624 fish species have been reportedly introduced worldwide (31). Exotic fishes are considered one of the major causes of decrease of native fish diversity in freshwater ecosystems (32, 33). The Exotic or alien species of fishes are the species are the non-native species that force the native species to move

them within or outside their natural ranges (30). Tilapia species are moderately belongs to this category.

The actual or potential impacts of the exotic species data have not been evaluated so far particular in Parbhani District. In this proposed work aim to study the potential of exotic species and their impacts on native fish fauna in selected water bodies and also the scenario of fish production.

Review of Literature and Development in the subject

(previous work done in the relevant area)

The farming of tilapias especially *Oreochromis niloticus* (Nile tilapia) in its natural form is believed to have originated more than 4000 years ago from Egypt. From the borders of their native, this versatile group of fish has travelled far, reaching every continent except Antarctica. Tilapias are now being cultured all over the world and in fact they are more common in Asia than in their African home land [14,21]. Most of the tilapia-culture practices have been restricted to tropical and sub-tropical regions of the world [22, 23].

Thys [18] described 77 species (besides a number of sub-species) of tilapia, and Jhingran & Gopalakrishnan [19] listed 22 species that have been used in experimental or production scale fish culture. The major cultivable species of tilapia are *Oreochromis niloticus* (Nile tilapia), *Oreochromis mossambicus*, (Mozambique tilapia), *Oreochromis aureus* (Blue tilapia), Oreochromis hornorum (Zanzibar tilapia) and Oreochromis hybrids (Red tilapia). Nile tilapia is the predominant cultured species worldwide.

More than 90 percent of all commercially farmed tilapia outside Africa are Nile tilapia. The hybrid "red" tilapia has also become increasingly popular for farming because of its similar appearance to the marine red snapper that gives it high market value. The original red tilapias were genetic mutants. Tilapia farming has gained its popularity in China, Bangladesh, Indonesia, Laos, Malaysia, Taiwan, Philippines and Vietnam. People do not treat it as exotic fish, instead regard as very important source of fish quality animal protein and income. The natural distribution of tilapia is restricted to Africa, Jordan, and Israel, where 112 species and subspecies of the genera Oreochromis, Sarotherodon, and Tilapia have been identified [10, 20].

In monosex culture, males are preferred because they have a faster growth rate than females. In addition, research on nutrition and culture systems, along with market development and processing advances, led to rapid expansion of the industry in the mid-1980s. Several species

of tilapia are cultured commercially, but Nile tilapia *Oreochromis niloticus* the predominant cultured species worldwide [4].

Tilapia farming ranges from a rural subsistence (extensive, low input practices, non-commercial and for household consumption) to a largescale (capital intensive, commercial purpose and market driven) level, depending on the intensity of management employed. Tilapia continued its rapid increase in global production through into 2015. Indonesia in particular reported a large increase in production. China held relatively steady after low prices held back production in late 2014 and early 2015. In 2014 and 2015 additional expansion with more farms and more productivity in Bangladesh, Mexico, Egypt, and Brasil. With recent production figures reported by various sources, our global production estimate for 2015 is 5,576,800 mt. China continued its position as the single largest producer (1,800,000 mt in 2015). Indonesia moved up to the second biggest producer with over 1,100,000 mt of production. Egypt dropped to the third biggest producer of tilapia in the world, even while increasing production to 800,000 mt in 2015. The ban of American and Bangladesh continued to increase its production at a tremendous rate. 2015 estimate is for more than 250,000 mt in Bangladesh.

Objectives of research / Proposed Hypothesis

To study the biology of Tilapia species including growth, reproduction (GSI, Fecundity) etc.

To develop the morphometric data of Tilapia species.

To collect the annual fish production data of the selected water bodies.

To study the effect of exotic Tilapia species on Native fish fauna.

To study the fish fauna of selected water bodies.

To study the catches of Tilapia species from the selected fish landing sites.

To study the Fish (Fishes) Catch Composition (%) year-wise – from the landing sites.

Methodology to be adopted

- ✓ Collection of fishes from the landing sites
- ✓ Preservation, Identification of fish fauna by using standard literature
- ✓ Growth rate, age of fish, spawning, fecundity, GSI.
- ✓ Regression and correlation analysis (for fish abundance)
- ✓ Population Density

- ✓ Feeds and Feeding habits by using standard literature
- ✓ Correlation between exotic and native fishes
- ✓ Relationship between Exotic and Indigenous fishes
- ✓ Collection of data on Landing of fishes from the selected sites
- ✓ Stratified sampling design for the collection of data (34, Tyagi and Mandal 2008)

Importance of Study / Society application

International Status

Native to Africa and Middle East, tilapias were introduced into some 90 countries for aquaculture and fisheries, through Pan-African transplants [12,13] during the 20th century. Presently, a major part of the global tilapia production is outside the fish's native ranges. Tilapias are now grown commercially in almost 10 countries and have become one of the most important food fishes in the world. It is the second most important farmed fish species after the carps.

In 1978, Nile tilapia was introduced to China, which leads the world in tilapia production and consistently produced more than half of the global production in every year from 1992 to 2003. The uncontrolled breeding of tilapia in ponds, which led to excessive recruitment, stunting and a low percentage of marketable-sized fish, dampened the initial enthusiasm for tilapia as a food fish. The development of hormonal sex-reversal techniques in the 1970s represented a major breakthrough that resulted in the production of male monosex populations to be raised to uniform, marketable sizes. Historically and from a social standpoint, the most important use of tilapia has been production for home consumption, with millions of small-scale fish farmers in more than 100 countries supplementing their diets with tilapia [24].

Tilapia is the second most farmed fish in the world after carps. The Global market for tilapia is growing at the rate of 10 – 12 % per year. More commonly, fresh tilapia also is provided for sale either at the farm gate or in local markets. However, tilapias have grown in importance from being just a low-cost, high-protein food fish ("aquatic chicken" [25]) employed by development agencies to feed the poor in the world's rural areas, to a highly-domesticated "livestock" with annual sales amounting to over $2 billion globally [2, 24].

In terms of economic importance, tilapia surpassed the salmonids in 2004, and they are expected to eventually equal the carps [24]. The tilapias have been referred to as the "most important global whitefish commodity" [26].

National Status

Tilapias are one of the most widely introduced fish globally that has clearly emerged as a very promising group in aquaculture. *Oreochromis mossambicus* was the first tilapia species to be taken up for large scale aquaculture, followed by *Oreochromis niloticus, Oreochromis aureus* and *Tilapia rendalli.* Today *Oreochromis niloticus* contributes more than 80% of global tilapia production by aquaculture.

In India, *Oreochromis mossambicus* was introduced from Srilanka in 1952 and thereafter stocked in several reservoirs of southern India for production enhancement [27]. Tilapia now forms a part of fish fauna in the Godavari, Krishna, Cauvery, Yamuna and Ganga Rivers [28]. *Oreochromis niloticus* was probably introduced unofficially in West Bengal in the late 1970s or early 1980s and in Andhra Pradesh during the late 80s. Through it was also popularized in the states of Kerala and Tamil Nadu, the overall experience with the species had not been encouraging as the fish turned out to be a prolific breeder, leading to over population and stunted growth in both aquaculture ponds and reservoirs.

Tilapia is also reported to have displaced and virtually eliminated a number of species from some reservoirs of India. Subsequently, the fish was abandoned as candidate species for aquaculture in the country [29].

Today *Oreochromis niloticus* is being cultured in some parts of the country mainly as a live feed for carnivorous fish such as seabass and forms a fishery in a few reservoirs and water bodies of Kerala, Tamil Nadu and Andhra Pradesh. Large quantities of small sized tilapia are also harvested and used as feed for seabass and mud crab aquaculture. Unlike *Oreochromis mossambicus,* growth performance of *Oreochromis niloticus* in the ponds and reservoirs of India is much better. Considering that *Oreochromis niloticus,* is the most widely cultured tilapia species globally and in view if the immense aquaculture possibilities in India and need for enhancing production in freshwater farming systems, the Ministry of Agriculture, Government of India formally issued guidelines for responsible farming of tilapia in India during December 2011.

Significance of the Study

This study elicited the potential effects of introduced tilapia species on native biodiversity which is informative for the fish biologist, aquaculturists, natural resource managers and other groups who are interested in culture or introduction of tilapias.

Tilapia farming will persist to be an important source of animal protein, foreign exchange and provide employment opportunities.

The culture of non-native fish species has increased rapidly in India over the last decade. The livelihoods of a large number of rural poor are associated with the farming and marketing of these non-native species. There has been a steady increase in the production of the fish by small and marginal farmers, who have improved their socioeconomic conditions through farming non-native species. Their culture provides huge contributions to the food supply, livelihood opportunities and poverty alleviation of rural poor.

Proposed work plan/ Formulation and Structure of Study

Year-wise Plan of work and targets to be achieved

- **First Year**: Course work, Review of Literature, experimental setup etc. Study of fish diversity of selected water bodies, biology of Tilapia species.
- **Second Year**: To study the population densities of fishes (%) species-wise form selected water bodies (landing sites) by using standard methods.
- **Third Year:** To study the impact of Exotic Tilapia species on local fishes, on basis of various parameters.
- **Fourth Year**: Result writing and data analysis, publication of research paper, thesis writing and submission to university.

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